Plan Summary

Introduction

This recovery plan serves as a roadmap for the protection and recovery of Oregon Coast coho salmon (*Oncorhynchus kisutch*). NOAA's National Marine Fisheries Service (NMFS) first listed Oregon Coast coho salmon as a threatened species under the Endangered Species Act (ESA) in 1998. NMFS relisted the species in 2008, and reaffirmed the listing status in 2011 (see Section 1 for a chronology and explanation, including the results of federal court decisions). NMFS will retain this listing status until the ESA goal is met ─ improving the status of the species and the habitat upon which it depends to the point where protection under the ESA is no longer required.

Oregon Coast coho salmon spawn and rear in Oregon rivers and lakes along the coast of the Pacific Ocean. The species' range includes the ocean and the Oregon Coast from the Necanicum River near Seaside on the north to the Sixes River near Port Orford on the south (Figure ES-1).

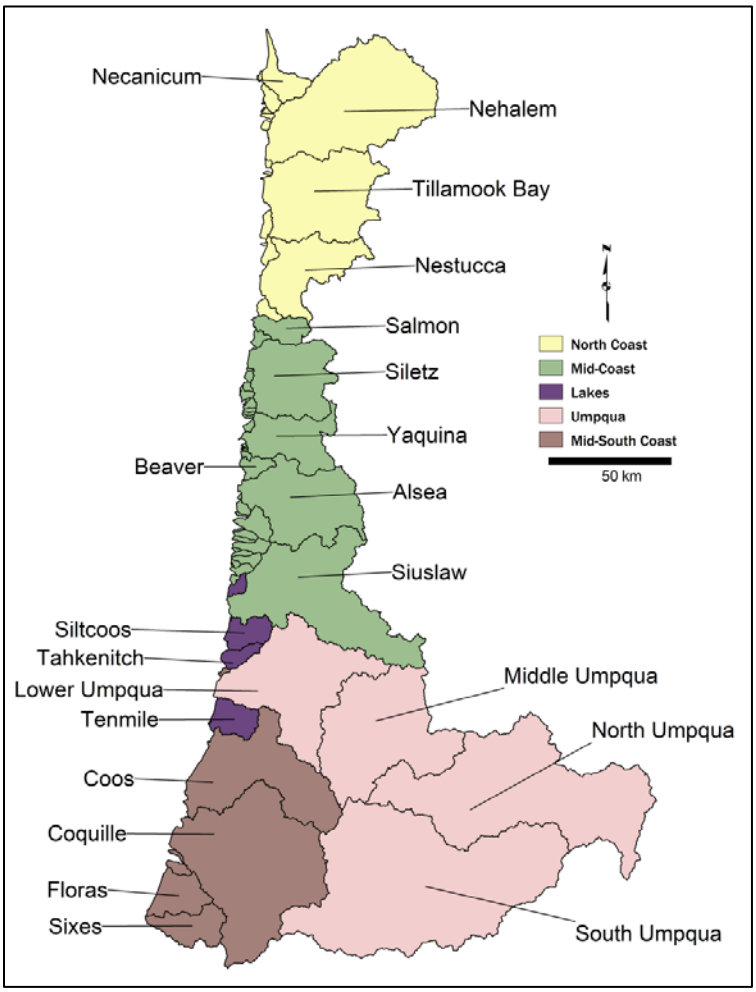

Figure ES-1. Map of Oregon Coast Coho Salmon ESU showing populations and strata (larger population groupings).

This recovery plan aims to establish self-sustaining, naturally spawning Oregon Coast coho salmon populations that are sufficiently abundant, productive, and diverse to persist in the long term, defined as the next 100 years. The species needs to be resilient enough to survive catastrophic changes in the environment, including events such climate change and decreases in ocean productivity. Overall, the recovery direction for Oregon Coast coho salmon has a single overriding focus: restoring degraded habitat and the ecosystem processes that affect the habitat. Most recommended actions target the protection and restoration of freshwater and estuarine habitats, especially habitats that support juvenile rearing coho salmon.

History and Perspective

During the 1800s and early 1900s, strong runs of coho salmon returned each year to rivers and lakes along the Oregon coast. The spawning run is estimated to have been in the range of one to two million during periods of favorable ocean conditions. The run began to decline in the mid-1900s and dropped to record lows ─ around 20,000 adults ─ in the late 1990s, leading to its listing under the ESA. (See Figure ES–2.) We attribute the species' drastic decline to multiple factors, including high harvest rates, high levels of production of hatchery coho salmon, significantly degraded habitat, and periods of poor ocean conditions.

Improvements made by multiple parties over the last twenty years have contributed to reversing the species' decline. With variable ocean conditions, recent coho salmon returns have fluctuated from a modern-era record of 350,000 down to approximately 100,000 (Figure ES-2) While the current status of Oregon Coast coho salmon is better than in the past, it remains unclear whether recent levels of abundance can be sustained. Adding to concern, recent projections indicate that we may be entering a new period of poor ocean conditions, which could result in reduced ocean survival rates and decreased ESU sustainability. This suggests that more actions are needed to ensure the species is sustainable and no longer needs ESA protection.

Why a recovery plan?

Oregon Coast coho salmon, which spawn and rear in rivers, streams and lakes along the coast of the Pacific Ocean, remain at risk of extinction. The once strong salmon run began to decline in the mid-1900s and dropped to record lows in the 1990s. This sharp decline persuaded NMFS to list the species as Threatened under the federal Endangered Species Act, and triggered many changes to stem the decline and bring the run back to a healthy level.

Many more coho salmon now return to Oregon's coastal stream systems than at the time of ESA listing but the run is still vulnerable, with the number of returning adults sometimes fluctuating greatly between years. The primary remaining bottleneck is lower than needed survival and productivity as the fish grow from eggs to smolts. More work is needed to take the species the remaining distance to reach a naturally self-sustaining level and ensure its long- term survival.

What is needed to reach recovery?

The recovery strategy aims to establish sustainable naturally spawning coho salmon populations that are sufficiently abundant, productive, and diverse and are likely to persist in the long term, defined as the next 100 years. The strategy's primary focus is to protect and restore the freshwater and estuarine rearing habitats upon which egg-to-smolt survival depends.

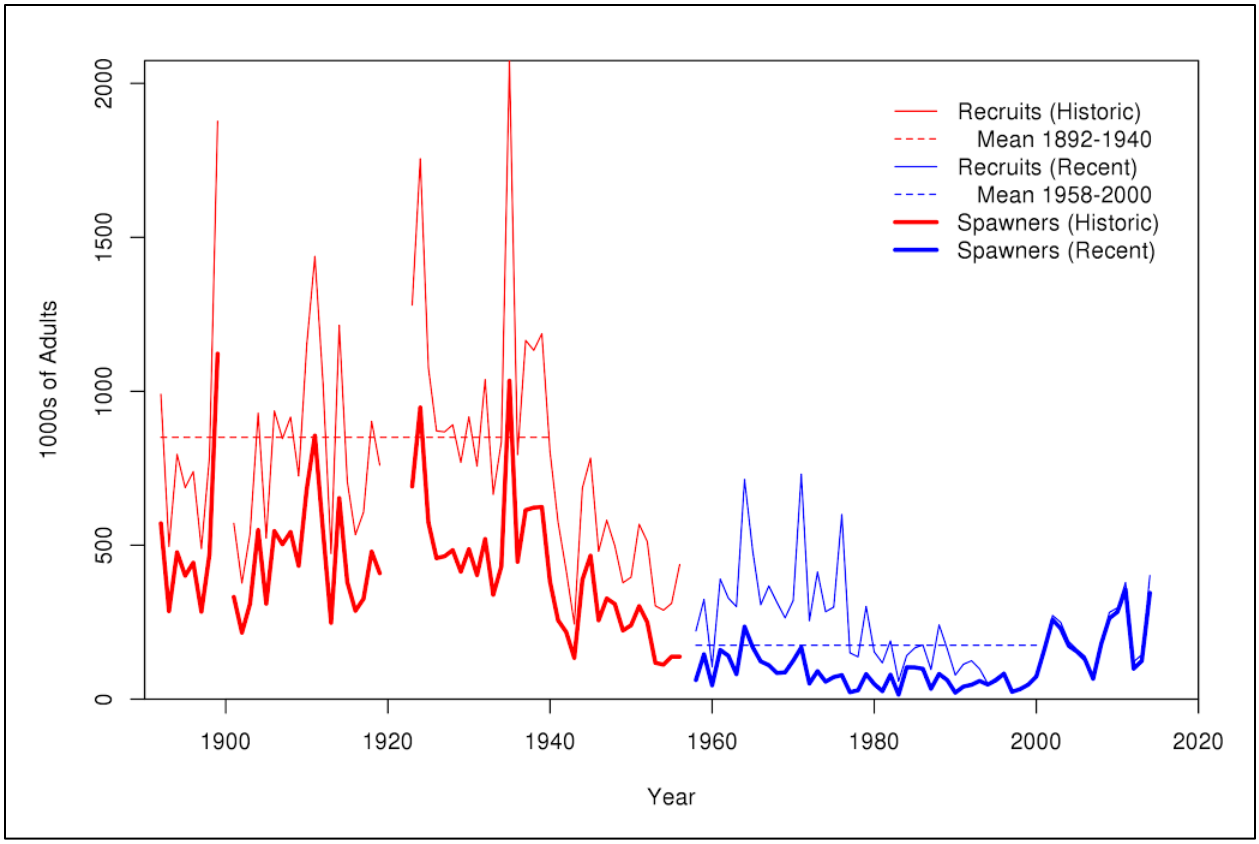

Figure ES-2. Historical Oregon Coast coho salmon abundance (1892-1958) compared to recent (1958-2014) estimates of spawner abundance and pre-harvest recruits. Horizontal lines are the geometric mean recruits for 1892–1940 and 1960–2009. Analysis based on data from Cleaver 1951, Mullen 1981a, and Mullen 1981b; recent data from Wainwright et al. 2008, ODFW 2009a, and Wainwright 2015.

About This Recovery Plan

This Recovery Plan (or Plan) provides information required to satisfy section 4(f) of the ESA. It describes: (1) recovery goals and objectives (measurable criteria which, when met, will result in a determination that the species be removed from the threatened and endangered species list); (2) site-specific management actions necessary to achieve the Plan's goals; and (3) estimates of the time required and cost to carry out the actions. It also describes factors and threats leading to the species ESA listing, as well as those that currently affect the species' sustainability. It includes recommendations for monitoring and evaluation and adaptive management to fine-tune the course towards recovery. NMFS intends to use the Plan to organize and coordinate recovery of the species working with local, state, tribal, and federal partners.

Building on Current Efforts

The Plan builds upon and complements ongoing conservation, restoration and research efforts for Oregon Coast coho salmon. NMFS developed the Plan through a collaborative effort that rides on a related planning process involving state and federal agencies, tribal and local governments, other regional stakeholder teams, representatives of industry and environmental groups, and individual landowners and the public. Through this approach, we aim to effectively address ESA goals while respecting local interests and needs based on social, economic, and ecological values. In particular, this federal recovery plan relies to a great extent on the direction

defined in the state's Oregon Coast Coho Conservation Plan (OCCCP or conservation plan). Our goals and the state's goals for Oregon Coast coho salmon are different but compatible. While this federal recovery plan focuses on getting to delisting, the state's conservation plan goals are broader and go beyond the ESA requirements. Consequently, our recovery plan incorporates many of the state conservation plan's strategies and actions, but it also includes additional measures. In particular, we recommend that the state enhance protective regulatory mechanisms that will help ensure that Oregon Coast coho salmon can meet ESA delisting criteria on activities such as agricultural, floodplain, and forest practices and others that affect water quality (see Section 6, Recovery Strategies and Actions).

NMFS will rely, to a great extent, on voluntary efforts by local citizens, landowners, and regional agencies and jurisdictions to implement actions identified in this Plan. Recovery plans are advisory, not regulatory, documents. NMFS intends to use the Plan to support the Oregon Coast Coho Conservation Plan as well as to inform federal, state and local agencies and interested stakeholders about what will be needed to recover Oregon Coast coho salmon to the point where they can be self-sustaining for the long term and can be removed from the list of threatened and endangered species.

Oregon Coast Coho Salmon and Habitat

Oregon Coast coho salmon are an evolutionarily significant unit (ESU) of coho salmon, a wide-ranging species of Pacific salmon. Coho salmon spawn in rivers and rear in streams and estuaries around the Pacific Rim from Monterey Bay in California north to Point Hope, Alaska; through the Aleutian Islands; and from the Anadyr River in Russia south to Korea and northern Hokkaido, Japan.

What is an evolutionarily significant unit (ESU)?

An ESU is a group of Pacific salmon that is (1) substantially reproductively isolated from other groups of the same species and (2) represents an important component of the evolutionary legacy of the species. ESUs are defined based on geographic range as well as genetic, behavioral, and other traits.
All Pacific salmon belong to the family Salmonidae and the genus Oncorhynchus. Coho Salmon belong to the species (*Oncorhynchus kisutch).*

The Oregon Coast coho salmon ESU includes the Pacific Ocean and the freshwater and estuarine habitat (rivers, streams and lakes) along the Oregon Coast from the Necanicum River near Seaside on the north to the Sixes River near Port Orford on the south. These rivers, streams, estuaries, and lakes lie within the Coast Range ecoregion, which displays low mountains covered by highly productive, rain-drenched coniferous forests. Rivers in this ESU flow from the mountains of the Coast Range, with the exception of the Umpqua River, which extends east through the Coast Range to drain the Cascade Mountains. Most of the rivers transition to estuaries before reaching the Pacific Ocean.

The anadromous life cycle for coho salmon begins in their home stream, normally a small tributary with moderate to low gradient stream reaches. After emerging from the gravel, the small fish seek cool, slow moving stream reaches with quiet areas such as backwater pools, beaver ponds, and side channels. They generally spend one summer and one winter in these freshwater areas before migrating as juveniles through the estuaries to the ocean. Low gradient stream reaches with complex stream habitat are particularly important for winter survival of

juvenile coho salmon because they provide shelter when flows are high, water temperatures are low, and food availability is limited. They are also important for summer survival, when high water temperatures can threaten the fitness and survival of juvenile salmon. Since coho salmon spend up to half of their lives in freshwater, the condition of the winter and summer juvenile rearing habitat is a key factor in their survival.

Most juvenile coho salmon migrate to the ocean as smolts in the spring, typically from late April until early June, although migration strategies are important as a feature of life history diversity. Coho salmon smolts may be present in estuaries for a period of weeks to perhaps a month during their migration to the ocean. During their stay in the estuaries they seek low-salinity gradients to grow and slowly acclimate to saltwater. They reside in shallow areas and side channels, as well as deeper channels and plumes of freshwater extending offshore at varying times of the year. Most adult coho salmon return to natal tributaries from September to November as 3-year-old fish, after spending two summers in the ocean (Figure ES-3). The early ocean life stage is believed to be a critical time for the fish since significant marine mortality can occur during the first two weeks to months of ocean life.

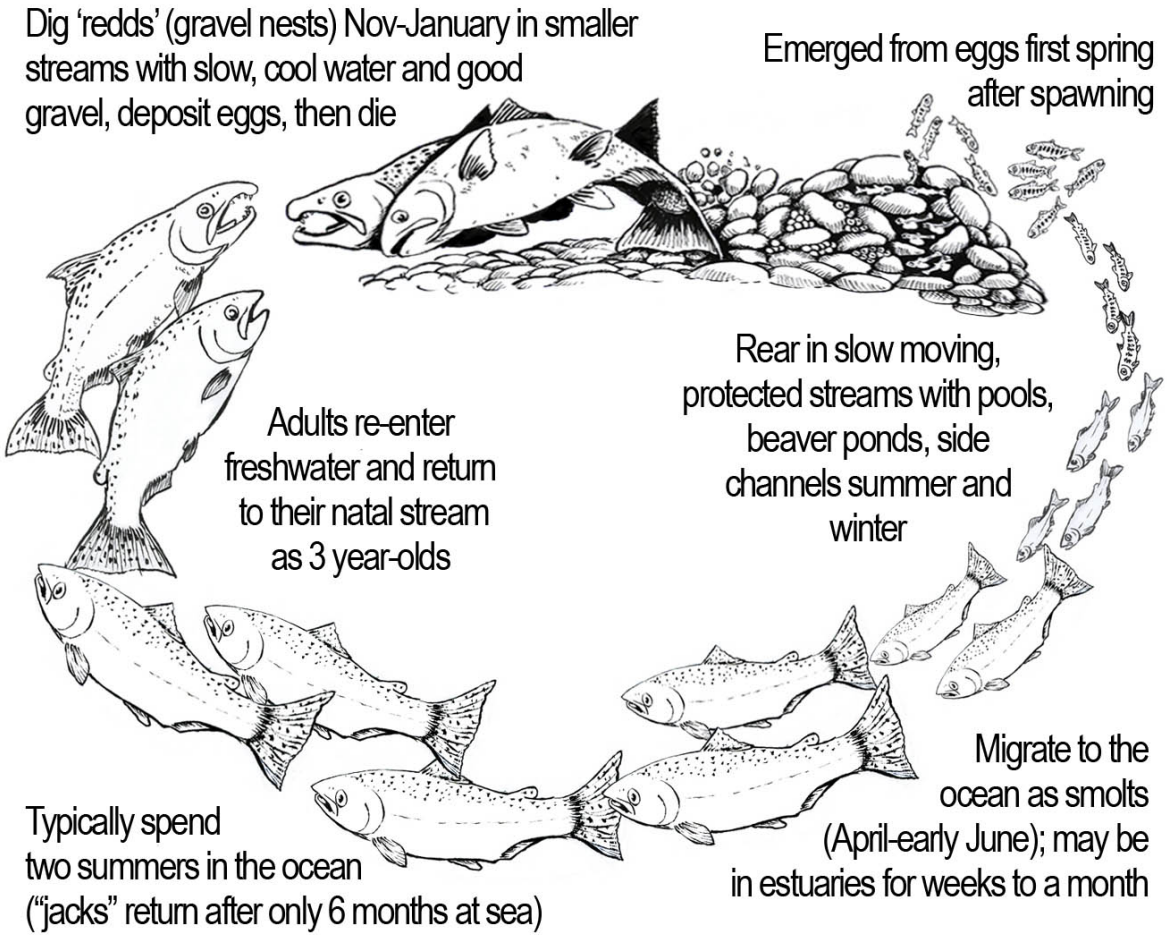

Figure ES-3. Oregon Coast coho salmon life cycle.

Listing Factors and Threats Analysis

Factors Leading to ESA Listing

Many human activities contributed to the ESA listing of Oregon Coast coho salmon as a threatened species. NMFS determined in 1998: "For coho salmon populations in Oregon, the present depressed condition is the result of several longstanding, human-induced factors (e.g., habitat degradation, water diversions, harvest, and artificial propagation) that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought, floods, and poor ocean conditions." A status review in 2003 by NMFS' biological review team found that risks posed by hatchery fish and fisheries had been greatly remedied, but questioned whether the ESU's deteriorated freshwater habitat was capable of supporting levels of coho productivity needed to sustain the species during periods of poor ocean conditions.

What are limiting factors and threats?

Limiting factors are the biological and physical conditions that limit a species' viability (e.g. high water temperature).

Threats are the human activities or natural processes that cause the limiting factors. The term "threats" carries a negative connotation; however, they are often legitimate and necessary human activities that at times may have unintended negative consequences on fish populations. These activities can be managed to minimize or eliminate the negative impacts.

Factors Affecting ESU Status Today

Several threats that contributed to the species' ESA listing, especially hatchery and harvest practices, have been addressed and now present little harm to the coho salmon populations. Other threats continue to threaten sustainability of the Oregon Coast coho salmon ESU (see Figure ES-4). We summarized the threats in Table ES-1 based on the listing factors described in the ESA section 4(a)(1):

A. The present or threatened destruction, modification, or curtailment of the species' habitat or range
B. Over-utilization for commercial, recreational, scientific, or educational purposes
C. Disease or predation
D. The inadequacy of existing regulatory mechanisms
E. Other natural or human-made factors affecting the species' continued existence

Today, Oregon Coast coho salmon are primarily affected by threats posed in two of these five categories: degraded habitat and the inadequacy of existing regulatory mechanisms (related to habitat). A 2012 review by NMFS' biological review team, found that the combination of past and ongoing forest management practices, along with lowland agricultural and urban development, has resulted in a situation where the areas of highest potential habitat capacity for coho salmon are now severely degraded. The review team determined that the long-term decline in Oregon Coast coho salmon productivity reflected deteriorating conditions in freshwater habitat, and that the remaining quality of the habitat may not be high enough to sustain species productivity during cycles of poor ocean conditions. This situation leaves the ESU vulnerable to near-term and long-term declines in ocean productivity, as well as to climate effects in freshwater.

Loss of stream habitat complexity to support overwinter rearing of juvenile coho salmon is especially a concern. A 2005 state of Oregon assessment identified reduced stream complexity as the primary or secondary limiting factor for all independent Oregon Coast coho salmon populations. This instream habitat is critical to produce high enough juvenile survival to sustain productivity, particularly during periods of poor ocean conditions. Habitat conditions that create sufficient complexity for juvenile rearing and overwintering include large wood, pools, connections to side channels and off-channel alcoves, beaver ponds, lakes, and connections to wetlands and backwater areas. The benefits to coho salmon from these habitat conditions are maintained through connection to the surrounding landscape. Beaver provide considerable help in providing this connection and in maintaining proper watershed functioning in Oregon coast streams.

Degraded water quality, including high water temperatures, increased fine sediment levels, and pollutants reduce coho salmon production in some population areas. The state's 2005 assessment identified water quality as the primary or secondary limiting factors for 13 of the 21 coho salmon populations in the ESU.

Impaired fish passage due to culverts, stream crossings, tide gates and other barriers also remains a concern in some streams and estuary areas, although many past barriers have been removed or redesigned to improve fish access. In addition, the coho salmon populations in lake areas and some lower stream reaches are further affected by predation from introduced warm water fishes, such as smallmouth and largemouth bass. Concerns posed by summer water temperature and predation rates may become more important in the future due to climate change, and there is increasing concern about predation from birds and marine mammals.

Table ES-1. Primary ESU-level threats and limiting factors for Oregon Coast coho salmon.

Listing Factor	Threat	Primary Limiting factors	Current level of Concern
LF A- *Destruction, modification or curtailment of habitat or range*	Historical, current and future land use activities that affect watershed functions that support coho habitat	Loss of stream complexity	High
		Degraded water quality	High
		Blocked/hindered passage	High
LF B- *Overutilization*	Overharvest of OC coho salmon in ocean and freshwater tributaries	Reduced abundance and productivity due to harvest mortality	Low
LF C- *Disease or predation*	Disease and increase in parasites	Reduced productivity due to increased infection	Low
	Predation from birds, marine mammals and warm water fishes	Reduces coho abundance and productivity	Medium
LF D- *Inadequacy of existing regulatory mechanisms*	Ineffective regulatory mechanisms	Lack of adequate habitat protection	High
LF E- *Other factors*	Hatchery operations and releases	Competition, predation and reduced diversity	Low
	Changes in ocean conditions	Reduced fitness and survival, thereby abundance and productivity	High
	Climate change	Further habitat degradation and thereby productivity	Medium- High

Recovery Goals and Delisting Criteria

The recovery plan provides recovery goals and criteria that NMFS expects to use in future status reviews of the Oregon Coast coho salmon ESU. The primary goal for the species is recovery to a self-sustaining condition. In the simplest terms, we will remove Oregon Coast coho salmon from ESA listing when we determine that:

- The species is sufficiently recovered from a biological perspective, and
- Factors that led to listing have been reduced or eliminated to the point where federal protection under the ESA is no longer needed.

NMFS aims to achieve this goal while recognizing broader needs ─ other social, cultural and economic values ─ regarding the Oregon Coast as well as the listed species. Section 4 describes the recovery goal and criteria.

ESA Recovery Goal: Our primary goal is that the ecosystems upon which Oregon Coast coho salmon depend are conserved such that the ESU is sustainable and persistent and no longer needs federal protection under the ESA.

Delisting Criteria: NMFS applies two kinds of ESA recovery, or delisting, criteria to determine if the recovery goal for the ESU has been achieved. The first, biological recovery criteria, examines the biological health (viability - sustainability and persistence) of the species (§4.2). The second, threats criteria, relate to the five listing factors in ESA section 4(a)(1) and describes the human activities (threats) that contributed to the decline in the status of the species. Together, the biological recovery criteria and threats criteria, described in Section 4, make up the "objective, measurable criteria" [delisting criteria] required under section 4(f)(1)(B)(ii) for the delisting decision (See Figure ES-4).

The two types of criteria allow NMFS to make a delisting decision based on the best available science concerning the current status of the species and its prospects for long-term survival.

1. Biological viability criteria define population or demographic parameters. The NMFS Technical Memorandum *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000) provides guidance for defining biological viability criteria. Consistent with this guidance, the Oregon and Northern California Coasts technical recovery team (TRT) defined viable salmonid population (VSP) parameters in terms of four measures: population abundance, population growth rate (productivity), population spatial structure, and diversity. These four measures (discussed in Section 4.2) form the basis for our evaluations of the individual salmon populations that comprise the species under the ESA.

   The technical recovery team's biological viability criteria focus on coho salmon status at the population level, and then "roll up" the combined status of the populations to determine the status of the ESU. The team's approach gathers the populations into five "strata", groups of populations with similar traits, and then combines the status of the five strata to determine the status of the ESU. The technical recovery team developed two principle elements within the biological criteria:

- Most of the independent populations had to be sustainable in each stratum.
- All five strata had to be sustainable for the whole ESU to be sustainable.

The team also considered risks that operate at a broader ESU-level scale. These risks relate to how populations interact with each other to preserve diversity, how multiple populations might be vulnerable to catastrophic events, and how ecosystem processes alter habitat features.

2. Listing Factors/ Threats criteria. At the time of a status review for the Oregon Coast coho salmon ESU, NMFS will examine whether the five listing factors previously described have been sufficiently abated to warrant delisting.

   Section 4.3.2 describes goals and criteria for assessing each of the five listing factors. Addressing these criteria will help to ensure that underlying causes of decline have been addressed and mitigated before the Oregon Coast coho salmon ESU is considered for delisting, and that adequate regulatory mechanisms are in place that ensure continued persistence of a viable species beyond ESA recovery and delisting.

NMFS will use the delisting criteria in making a listing determination based in the biological status of the Oregon Coast coho salmon ESU and the five listing factors. Section 4.4 introduces a framework for assessing the biological status and listing factors. It also shows how the framework could be applied to take all these into consideration in a future listing determination, tailoring the ESA requirements to Oregon Coast coho salmon.

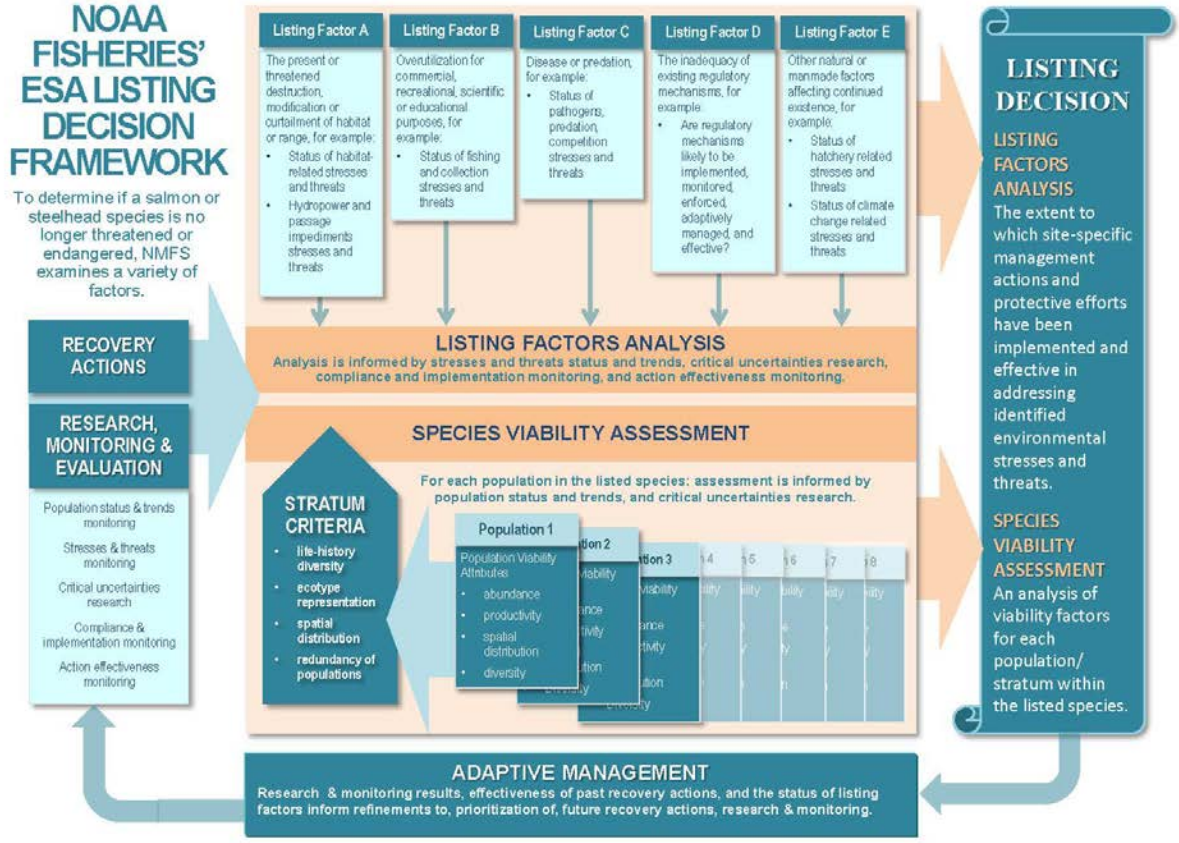

Figure ES-4. Framework components of an ESA-listing determination.

Current ESU Status

Since ESA listing, significant progress has been made toward ensuring that the Oregon Coast coho salmon ESU is sustainable and persistent and no longer needs federal protection under the ESA. In the most recent biological status review (published in 2012), members of our science team determined that they had a low to moderate certainty that the ESU was sustainable (viable) but "concluded that, when future conditions are taken into account, the (Oregon Coast coho) ESU as a whole is at moderate risk of extinction." The team was primarily concerned that the overall productivity of the ESU has remained low, and described the ESU's vulnerability to near-term and long-term climate effects and periods of poor ocean conditions. Based on the science team's review and NMFS' analysis of the five listing factors, NMFS determined that the species should remain threatened under the ESA due to uncertainties about the current quality of freshwater habitats, and that climate change could lead to a long-term downward trend in freshwater and marine coho salmon habitat compared to current conditions. Since the science team's review, Oregon Coast coho salmon abundance has increased, and then fluctuated. Consequently, uncertainty remains about the adequacy of the habitat and habitat protections in light of expected future downturns in ocean survival and climate change. Uncertainty also exists concerning predation effects on Oregon Coast coho salmon from non-native fish species, such as smallmouth and largemouth bass, as well as birds and marine mammals.

Recovery Strategies and Actions

Our recovery strategy for Oregon Coast coho salmon is designed to meet the ESA recovery goal and criteria for delisting. It aims to establish self-sustaining, naturally spawning populations that are sufficiently abundant, productive, and diverse so they no longer need ESA protection. As the species continues to recover over time, NMFS supports the attainment of broader goals that go beyond achieving species recovery under the ESA and provide multiple ecological, cultural, social and economic benefits.

Overall, our recovery direction for Oregon Coast coho salmon centers on restoring degraded habitats and the ecosystem processes and functions that affect those habitats. The primary focus is to protect and restore freshwater and estuarine rearing habitats upon which egg-to-smolt survival depends. Increasing habitat quality and capacity for over-wintering and summer rearing juvenile coho salmon is critical. Related state and federal scientific reports and findings identify reduced stream complexity and degraded water quality (increased temperature) as the primary factors that continue to threaten ESU viability. We include habitat strategies and actions for each of the five strata in Section 6. For the Lakes Stratum populations (Siltcoos, Tahkenitch, and Tenmile Lakes), predation by warm water fish also restricts recovery. At the same time, we will participate in decisions to maintain harvest rates and hatchery practices at levels that continue to support recovery.

Developing Scientifically Sound, Coordinated Approaches to Recovery

Our strategy is to develop and apply well-formulated, scientifically sound approaches to address the primary limiting factors for Oregon Coast coho salmon. It recognizes that habitat restoration efforts should begin with restoring natural watershed or ecosystem processes and addressing indirect threats instead of focusing at the project-level scale. Thus, efforts to increase stream complexity, improve water quality, and address predation and other limiting factors will include steps to protect and restore the ecosystem processes that influence habitat health and stability. Critical to this effort, NMFS aims to strengthen partnerships with local organizations, including watershed councils and soil and water conservation districts, local and state governmental agencies, and others to provide collaboration toward recovery and conservation of Oregon Coast coho salmon populations. NMFS will rely on a combination of regulatory programs plus effective long-term participation in non-regulatory, voluntary conservation work to achieve ESU viability.

Further, our strategy recognizes the importance of linking actions at the population and watershed levels to those at the ESU level. At the ESU level, we will create a common framework to provide a strategic approach to recovery that coordinates efforts to improve key watershed processes and habitats so they effectively support recovery goals for individual coho salmon populations and ESU. This consistency also supports adaptive management by improving our ability to assess the effectiveness of salmon recovery efforts, to identify uncertainties, and to update priorities and actions. At the watershed or population level, we aim to collaborate on the development of a step-by-step approach to define site-specific strategies and actions that will integrate the best available science.

We intend this Plan to serve as a ‘roadmap’ that describes alternate routes (strategies and actions) to get to recovery because there is no one ‘right’ way to get success. NMFS recognizes

two fundamental ingredients in any successful effort to protect habitat and recover protected efforts – 1) applying the best available science and 2) obtaining sufficient local support to implement strategic plans. A universal challenge associated with stream and river restoration is effectively integrating the two, and we approach the recovery effort for Oregon Coast coho salmon with a goal of achieving that integration. Where local plans incorporate both, we support them; where they need strengthening, we will work with ODFW and other agencies to help improve the plans.

Management Actions

Because of the many similarities between the habitats of the populations, we provide a list of site-specific habitat management actions that are generally applicable to the ESU, followed by strata-level actions. Many of the actions aim to restore and maintain ecological processes in the watersheds that create healthy habitat conditions. This list (shown, in part, in the following text box and in more detail in Section 6) is intended to serve as a 'menu' of the types of site-specific management actions that will contribute to the recovery of Oregon Coast coho salmon. The actions will be further refined, sequenced and scheduled during future development of the Recovery Implementation Schedule. In addition, we will continue to participate in processes to ensure that fisheries and hatcheries are managed to achieve and maintain a sustainable Oregon Coast coho salmon ESU.

- Regulatory actions. On the regulatory front, it is important to strengthen laws and/or regulations related to some habitat altering actions and/ or boost enforcement of existing regulatory mechanisms to provide habitat conditions that can support a sustainable ESU. Thus, an important element in our Plan is to identify regulatory changes that could, if implemented, address indirect threats ─ the roots causes of ecosystem impairment.

  At the same time, we will support the reforms already implemented for Oregon Coast coho salmon harvest and hatchery management and work with ODFW, the Pacific Fishery Management Council, and others to update these reforms as needed to achieve and maintain ESU viability.

- Voluntary actions. In the long run, protection and restoration of salmon habitat will only be accomplished if the people who call the area home make that a priority. We will continue to encourage and support conservation work by private landowners, local conservation groups (soil and water conservation districts, watershed councils, forestland owners, Salmon and Trout Enhancement Program (STEP) volunteers, etc.) and others to improve ecological processes and habitats, particularly in areas with the greatest potential to create and/or support high quality coho salmon rearing habitat.

- Research, monitoring, and evaluation actions. We recognize the remaining unknowns regarding our understanding of the specific factors that affect the fish now, or might influence their recovery in the future. As a result, the Plan includes actions to gain critical information about the factors that affect the fish, or may affect the fish in the future given global climate change. Continuing effective research, monitoring, and evaluation is critical to our success. Information gained through these efforts will be used to assess and, where necessary, correct recovery strategies and actions.

Potential Management Actions for Recovery of Oregon Coast Coho Salmon

Listing Factor A: Habitat Actions (includes actions for Listing Factor D)
Habitat actions at the ESU Scale

- A1.1 Revise regulatory mechanisms in order to provide increased protection for Oregon Coast coho salmon habitat.
- A1.2 Develop and update guidance for Oregon Coast coho salmon conservation and recovery.
- A1.3 Provide secure financial support to implement actions needed at achieve recovery.

Potential site-specific management actions at the stratum and population scales

- A2.1 Develop and approve scientifically credible, thorough Strategic Action Plans (SAPs) using a common framework developed for this Plan[1], for each independent population. Implement the best available science, including, when available, life cycle models.
- A2.2 Implement the SAP in each independent population to protect and restore ecosystem functions and coho habitat, evaluating each of the threat categories and implementing local activities consistent with the recovery strategies in this section.
- A2.3 Develop and implement SAPs, as resources allow, for dependent populations to prevent degradation of population status.
- A2.4 Plan and provide public outreach, including education and promoting volunteer efforts.

Habitat research, monitoring, and evaluation actions

- A3.1 Continue to provide research, monitoring, and evaluation to track ecosystem processes and habitat conditions to inform the adaptive management of recovery implementation.
- A3.2 Continue to monitor habitat conditions and trends at the strata level and if possible expand the monitoring to include non-wadable streams, wetlands, and estuaries and population-level trends.
- A3.3 Develop a means to track the gain and loss of key habitat features to estimate net changes in coho salmon habitat at the watershed scale.
- A3.4 Enhance the temperature monitoring system on the coast to better track warm -water and cold-water refugia.
- A3.5 Implement monitoring to track progress toward achieving recovery goals.
- A3.6 Conduct climate change risk analysis for habitats in all population areas.

Listing Factor B: Harvest Actions (includes actions for Listing Factor D)

- B1.1 Maintain abundance-based harvest management, adaptively managing to ensure harvest levels are not too high if marine survival is projected to be very low.
- B1.2 Review and amend as appropriate the definition and use of 'full seeding' in harvest management.

Listing Factor C: Predation and Disease Actions (includes actions for Listing Factor D)

- C1.1 Monitor for predation (especially in the Lakes populations), disease, aquatic invasive species, and competition and develop actions as needed.
- C1.2. Develop actions to control warm water fish predation on salmonids in the Lakes populations and lower Umpqua River.

Listing Factor E: Other Issues – Hatchery Management and Climate Change (includes actions for Listing Factor D)
Hatchery Management

- E1.1 Continue the release of hatchery fish to control mixing of hatchery-origin fish with wild fish on spawning grounds.
- E1.2 Continue the release of hatchery fish to reduce competition and predation with wild fish in tributaries and estuaries.

Climate Change

- E2.1 Monitor for increasing water temperatures (climate change) and 'flashiness' of streams.
- E2.2 Use information from climate change risk analysis to identify at risk populations and habitat areas and to help prioritize actions.

Time and Cost Estimates

There are unique challenges related to estimating time and cost for salmon recovery, given the complex relationship of the fish to the environment and to human activities. The recovery plan contains a list of actions to recover the populations; however, it recognizes that there are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include the rate at which new actions are implemented, biological and ecological

responses to recovery actions, scientific uncertainty regarding unforeseen changes in climate or ocean conditions, as well as long-term and future funding.

The time needed to recover Oregon Coast coho salmon under the ESA depends on near-term conditions (marine and freshwater), the actions that are implemented, and how effective the actions are in addressing remaining limiting factors and threats. For instance, if the biological status were good and Oregon were to revise key regulatory mechanisms ─ including floodplain management, agricultural and forest practices, and water quality rules ─ it is possible that we could delist Oregon Coast coho salmon in relatively few years, depending on the specifics of the new mechanisms and the speed and effectiveness of implementation. On the other hand, without significant changes in regulatory mechanisms, relying for the most part on the funding and implementation of voluntary actions, and depending on marine conditions, it could take ten years or more to recover and delist the species.

NMFS believes that, due to the many uncertainties, it is most appropriate to focus costs on the first five years of implementation, with the understanding that before the end of each five-year implementation period, specific actions and costs will be estimated for subsequent years. We base our costs on those provided in the Oregon Coast Coho Conservation Plan and the implementation of the Oregon Plan for Salmon and Watersheds, and assume continued expenditures at approximately the same level as in the last 17 years. Based on these assumptions, we estimate the cost of recovery for the next five years to be approximately $55 million and at approximately $110 million to achieve recovery, depending greatly on the ability to target habitat restoration activities to areas where the greatest gains can be made in improving winter and summer rearing habitats. The cost will also depend on success in improving laws and regulations to protect coho salmon habitat, and then enforcing them. These numbers do not include potential direct and opportunity costs to private sector businesses, depending on the actions and regulatory mechanisms implemented, nor do they include financial benefits that we expect to result from successful recovery of the Oregon Coast coho salmon ESU. Section 7 discusses our time and cost estimates.

Implementation

Ultimately, recovery of Oregon Coast coho salmon depends on the commitment and dedicated actions of the many groups and individuals who share responsibility for the species' future. Recovery plan implementation involves many entities and stakeholders, and the needs for coordination are complex and occur at multiple levels. Implementation and coordination needs exist at the regional, state, ESU, population and watershed levels and involve government and non- governmental entities.

Implementation of recovery actions has been improving Oregon Coast coho salmon sustainability since ESA listing. This recovery plan seeks to build upon the successful efforts by these different forums. It also provides a full life-cycle context for assessing the collective and relative effectiveness of ongoing actions, evaluating uncertainties, and identifying the most effective actions for the species and delisting.

We will continue to partner with the state of Oregon to integrate implementation of this recovery plan with similar efforts to implement the state Oregon Coast Coho Conservation Plan, including

development of site-specific management actions.

Adaptive Management, Research, Monitoring, and Evaluation

Adaptive management plays a critical role in recovery planning (See Figure ES-5). The long-term success of recovery efforts will depend on the strategic use of research, monitoring, and evaluation to provide useful information to decision makers within an adaptive management framework. Research, monitoring, and evaluation programs associated with recovery plans need to gather the information that will be most useful in tracking and evaluating implementation and action effectiveness and assessing the status of listed species relative to recovery goals. Planners and managers then need to use the information collected to guide and refine recovery strategies and actions. Adaptive management provides the mechanism to facilitate these adjustments.

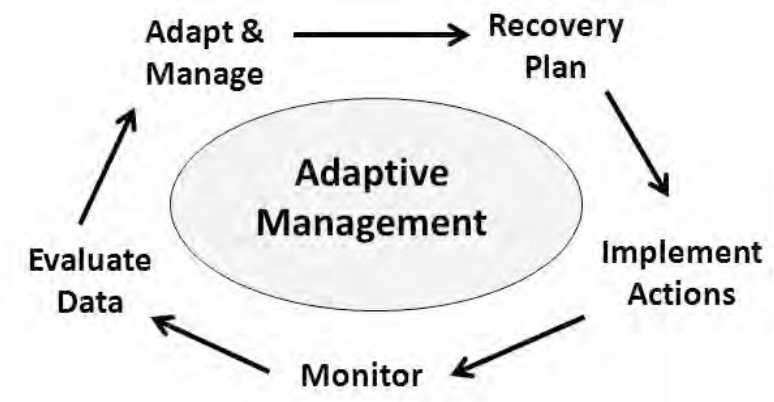

Figure ES-5. The Adaptive Management Cycle.

Successful adaptive management requires that monitoring and evaluation plans be incorporated into overall implementation plans for recovery actions. These plans should link monitoring and evaluation results explicitly to feedback on the design and implementation of actions (Figure ES-5). In adaptive management, recovery strategies are treated like working hypotheses that can be acted upon, tested, and revised. The research, monitoring, and evaluation plans will frame activities to answer remaining key questions, including the following: (1) is the status of the ESU improving? (2) Is the freshwater habitat good enough to support coho salmon productivity during expected future periods of poor ocean survival? (3) Is the habitat at the ESU, strata and population levels getting better? (4) Are the regulatory mechanisms pertaining to land use and water quality 'adequate' to meet ESA requirements?

For Oregon Coast coho salmon, NMFS intends to support implementation of the adaptive management, research, monitoring, and evaluation programs in the Oregon Coast Coho Conservation Plan. We will also develop a life-cycle model to identify and assess potential factors that could limit sustainability of Oregon Coast coho salmon, including effects under current climate change projection scenarios.